

### **REMARKS**

This Amendment responds to the Office Action mailed January 2, 2008. Claims 1-26 were pending in the application. Claims 1, 8-14, 21-23 and 26 are amended to more particularly recite the present invention. Claims 24 and 25 are cancelled without prejudice or disclaimer. New claims 27 and 28 are added. No new matter is added by way of the claim amendments or new claims. Thus, claims 1-23, and 26-28 are now pending for reconsideration.

Applicants thank the Examiner for considering the Information Disclosure Statements filed in this application.

#### ***Summary of the Office Action***

In the Office Action, claims 1-26 stand rejected as follows:

claim 20 is rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for reciting an element with insufficient antecedent basis;

claims 12 and 23 are rejected under 35 U.S.C. § 112, second paragraph, as being incomplete for omitting essential steps;

claims 1, 4-5, 14, 17-18 and 26 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,358,208 to Lang et al.;

claims 1-7, 14-20 and 26 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,534,221 to Fife et al.;

claims 1, 5, 9-11, 14, 18, 22 and 26 are rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,442,713 to Wilson et al.

claims 8 and 21 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Lang in view of U.S. Patent No. 5,361,767 to Yukov;

claims 12-13 and 23-25 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Lang.

The rejections are respectfully traversed based upon the foregoing amendments and the following remarks.

### ***Support for New Claims***

New claim 27 is fully supported in the specification in paragraphs [0031] and [0035] of the corresponding U.S. Patent Application Publication No. 2005-0240103. New claim 28 is fully supported in the specification in FIG. 4 and paragraphs [0027] through [0035] in the corresponding published application. Allowability of new claims 27 and 28 claim is addressed below in conjunction with the corresponding system claim 13.

### ***Response to the Rejection of Claim 20 under 35 U.S.C. § 112, 2<sup>nd</sup> paragraph***

Claim 14 has been amended to recite that the ultrasound imaging system includes “a catheter-based ultrasound probe.” This amendment to claim 14 provides the proper antecedent basis for the term objected to in the rejection of claim 20. Accordingly, Applicants respectfully request withdrawal of the rejection of claim 20 under 35 U.S.C. § 112, second paragraph.

### ***Response to the Rejection of Claims 12 and 23 under 35 U.S.C. § 112, 2<sup>nd</sup> paragraph***

Claims 12 and 23 have been amended as suggested by the Examiner to recite the complementary step appropriate when the second image’s resolution is better than the resolution of the first image. Accordingly, Applicants respectfully request withdrawal of the rejections of claims 12 and 23 under 35 U.S.C. § 112, second paragraph.

### ***Response to the Rejections under 35 U.S.C. §§ 102 (b) and 103(a)***

The amendments and the allowability of each of the pending claims are addressed below in discussions grouped according to like claim elements. As explained below, each pending claim is neither anticipated nor obvious in view of the asserted references. To set the stage for this discussion, the following deficiencies in the asserted references need to be emphasized.

Lang does not disclose or suggest a catheter-based ultrasound probe. Instead, Lang discloses microtransducers that can be applied to the surface of a patient in order to measure “interstitial layer thickness (ILT).” See Lang, col. 6, ll. 15-19 read in context with the portions of Lang cited by the Examiner. Lang also does not disclose or suggest

incrementally adjusting frequencies nor comparing image resolutions to select an optimum imaging frequency.

Fife does not disclose or suggest a catheter-based ultrasound probe. Fife also does not disclose or suggest incrementally adjusting frequencies nor comparing image resolutions to select an optimum imaging frequency.

Wilson does not disclose or suggest a catheter-based ultrasound probe and does not disclose changing imaging frequency at all. Instead, Wilson contemplates fixed frequency ultrasound transducers and, as noted in the Office Action, merely measures the change in the “frequency of the reflected signal after being attenuated by the tissue. Office Action p. 4. Thus, Wilson has little if any relevance to the pending claims in the present application which all concern automatic adjustments to the imaging frequency applied to a catheter-based ultrasound probe.

#### **Response re claims 1, 14 and 26**

Claims 1 and 26 are amended to recite “a catheter-based ultrasound probe coupled to the controller,” and adjusting the frequency of “signals applied to the catheter-based ultrasound probe.” Similarly, claim 14 has been amended to recite that the ultrasound imaging system includes “a catheter-based ultrasound probe coupled to the controller,” and adjusting the frequency of “signals applied to the catheter-based ultrasound probe.” Not one of the cited references discloses or suggests a catheter-based ultrasound probe, and instead concern external transducers. Since the cited references fail to teach or suggest all elements of claims 1, 14 and 26 as amended, Applicants respectfully submit that these claim are patentable over the cited references. Accordingly, Applicants respectfully request withdrawal of the rejections under 35 U.S.C. § 102(b) of amended claims 1, 14 and 26.

#### **Response re claims 2-3 and 15-16**

In addition to depending from allowable claims (1 or 14), claims 2-3 and 15-16 recite steps that are not disclosed or suggested in the cited references. Specifically, claims 2 and 15 recite selecting imaging frequencies from a range of incremented frequencies separated by increments of about 0.5 MHz. Similarly, claims 3 and 16 recite

selecting imaging frequencies from a range of incremented frequencies separated by increments of about 0.1 MHz. While some references discuss the merits of different ultrasound frequencies, none disclose or suggest these specific recited elements. Accordingly, Applicants submit that claims 2-3 and 15-16 are allowable over the cited references for depending from allowable claims (1 or 14) and for additionally reciting a limitation not disclosed or suggested in the cited references. Accordingly, Applicants respectfully request withdrawal of the rejections under 35 U.S.C. § 102(b) of amended claims 2-3 and 15-16.

**Response re claims 4-5 and 17-18**

Applicants submit that claims 4-5 and 17-18 are allowable over the cited references for depending from allowable claims (1 or 14). Accordingly, Applicants respectfully request withdrawal of the rejections under 35 U.S.C. § 102(b) of amended claims 2-3 and 15-16.

**Response re claims 6-7 and 19-20**

In addition to depending from allowable claims (1 or 14), claims 6-7 and 19-20 recite steps that are not disclosed or suggested in the cited references. Specifically, claims 6 and 19 recite receiving a user request for a scan through a range of frequencies, while claims 7 and 20 recite progressively determining a next imaging frequency for the scan through the range of frequencies. Applicants could not find any teaching or suggestion in the cited references for conducting a scan through a range of frequencies or of receiving a user input to do such a scan. Accordingly, Applicants submit that claims 6-7 and 19-20 are allowable over the cited references for depending from allowable claims (1 or 14) and for additionally reciting limitations not disclosed or suggested in the cited references. Accordingly, Applicants respectfully request withdrawal of the rejections under 35 U.S.C. § 102(b) of amended claims 6-7 and 19-20.

**Response re claims 8 and 21**

In addition to depending from allowable claims 1 and 14, respectively, claims 8 and 21 recite steps that are not disclosed or suggested in the cited references. Specifically, claims 8 and 21 recite receiving a user indication of a feature within an

image, automatically determining an imaging frequency corresponding to the depth of the selected feature and automatically adjusting the frequency applied to the catheter-based ultrasound probe. There is no image generated from a catheter-based ultrasound probe in Lang from which a user can select a feature of interest nor is there any discussion of the system for receiving such a user input. Instead, the microtransducers can be applied to the skin in order to measure an interstitial layer *thickness* (ITL). While Yukov discloses calipers, the disclosure does not rectify the deficiencies in Lang. Thus, the combination suggested in the Office Action of Lang and Yukov fails to disclose all of the elements recited in amended claims 8 and 21. Accordingly, Applicants submit that claims 8 and 21 are allowable over the cited references for depending from allowable claims 1 and 14, respectively, and for additionally reciting a limitation not disclosed or suggested in the cited references. Accordingly, Applicants respectfully request withdrawal of the rejections under 35 U.S.C. § 103(a) of amended claims 8 and 21.

#### **Response re claims 9 and 22**

In addition to depending from allowable claims (1 or 14), claims 9 and 22 recite steps that are not disclosed or suggested in the cited references. Specifically, claims 9 and 22 recite automatically adjusting the frequency of signals applied to the catheter-based ultrasound probe. As noted above, Wilson discloses only a fixed frequency transducer and using changes in the received echo frequency to adjust the number of transducers used in an array. Thus, Wilson fails to disclose the central aspect of the system and method of automatically adjusting the emitted ultrasound frequency. Accordingly, Applicants submit that claims 9 and 22 are allowable over the cited references for depending from allowable claims (1 or 14) and for additionally reciting limitations not disclosed or suggested in the cited references. Accordingly, Applicants respectfully request withdrawal of the rejections under 35 U.S.C. § 102(b) of amended claims 9 and 22.

#### **Response re claim 10**

In addition to depending from allowable claims 1 and 9, amended claim 10 recites that the controller is further configured to receive a signal from an electrocardiogram

(ECG) and correlate the signal with the received ultrasound image. Nowhere in the cited references is there a teaching or suggestion that the ultrasound image can be correlated to an ECG signal. Accordingly, Applicants submit that claim 10 is allowable over the cited references for depending from allowable claims 1 and 9 and for additionally reciting limitations not disclosed or suggested in the cited references. Accordingly, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. § 102(b) of amended claim 10.

**Response re claim 11**

In addition to depending from allowable claims 1 and 9, claim 11 recites that the controller is further configured to compare the determined signal attenuation to a predicted signal attenuation and adjust the frequency applied to the catheter-based ultrasound probe if the determined attenuation exceeds the predicted attenuation by at least a known value. Wilson teaches away from adjusting the ultrasound frequency applied to the probe, and therefore also teaches away from adjusting the frequency if the determined attenuation exceeds a threshold. Accordingly, Applicants submit that claim 11 is allowable over the cited references for depending from allowable claims 1 and 9 and for additionally reciting limitations not disclosed or suggested in the cited references. Accordingly, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. § 102(b) of amended claim 11.

**Response re claims 12 and 23**

In addition to depending from allowable claims 1 and 14, respectively, claims 12 and 23 recite steps that are not disclosed or suggested in the cited references. Specifically, amended claims 12 and 23 recite a series of steps for automatically measuring image resolution of two images acquired at two different frequencies, of automatically comparing the measured resolutions, and selecting an imaging frequency based upon the comparison. By adding the clarifying amendments to limit the measurements, second frequency adjustment and resolution comparisons to automatic processes (i.e., processes conducted by an automatic system such as the controller recited in claim 1), the claims are no longer claiming a “guess and check” scenario. Applicants

could not find any teaching or suggestion in the cited references for conducting the automated steps recited in claims 12 and 23. Accordingly, Applicants submit that claims 12 and 23 are allowable over the cited references for depending from allowable claims 1 and 14, respectively, and for additionally reciting limitations not disclosed or suggested in the cited references. Accordingly, Applicants respectfully request withdrawal of the rejections under 35 U.S.C. § 103(a) of amended claims 12 and 23.

**Response re claim 13 and allowability of new claims 27 and 28**

In addition to depending from allowable claim 1, amended claim 13 recites steps that are not disclosed or suggested in the cited references. Specifically, amended claim 13 recites the series of steps recited in claim 12 for automatically measuring image resolution of two images acquired at two different frequencies, of automatically comparing the measured resolutions, and selecting an imaging frequency based upon the comparison. As discussed above with regards to claim 12, recited steps overcome the rejection under 35 U.S.C. § 103(a). Additionally, the amended claim recites that the processor is further configured to receive signals from an ECG, correlate those signals with an image, and acquire the first and second images at approximately the same point in the cardiac cycle. Support for these additional elements are provided in paragraphs [0031] and [0035] in the corresponding published application. New claims 27 and 28, which depend from claims 14 and 26, respectively, recite elements very similar to those in amended claim 13. The cited references do not teach or suggest acquiring images at approximately the same point in the cardiac cycle, nor comparing measured image resolutions and automatically adjusting the frequency applied to a catheter-based ultrasound probe based upon the comparison. Accordingly, Applicants submit that claims 13, 27 and 28 are allowable over the cited references for depending from allowable claims 1, 14 and 26, respectively, and for additionally reciting limitations not disclosed or suggested in the cited references. Accordingly, Applicants respectfully request withdrawal of the rejection under 35 U.S.C. § 103(b) of amended claims 12 and allowance of new claims 27 and 28.

**Conclusion**

In view of the above amendments and remarks, Applicants respectfully request that all objections and rejections be withdrawn and that a notice of allowance be forthcoming. The Examiner is invited to contact the undersigned for any reason related to the advancement of this case.

Since this Amendment is filed within the shortened statutory period for response and does not increase the number of claims Applicants believe that no fee is required with this submission. Nevertheless, the Commissioner is hereby authorized to credit any overpayment or charge any deficiency to Deposit Account No. 50-3869.

Respectfully submitted,



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